

## PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

|  |  |  |                       |
|--|--|--|-----------------------|
| Applicant's or agent's file reference<br>22188--06784  | <b>FOR FURTHER ACTION</b>  |  | See Form PCT/IPEA/416 |
| International application No.<br>PCT/US04/11302  | International filing date (day/month/year)<br>13 April 2004 (13.04.2004) | Priority date (day/month/year)<br>14 April 2003 (14.04.2003) |                       |
| International Patent Classification (IPC) or national classification and IPC<br>IPC(7): F16K 7/16, 1/46 and US Cl.: 251/331, 359 |  |  |                       |
| Applicant<br>SWAGELOK COMPANY  |  |  |                       |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 27 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 10 sheets, as follows:

☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I Basis of the report

☐ Box No. II Priority

☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

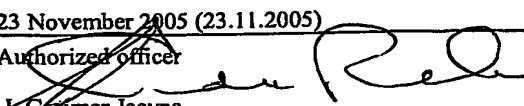
☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

☐ Box No. VI Certain documents cited

☐ Box No. VII Certain defects in the international application

☐ Box No. VIII Certain observations on the international application

|  |   |
|--|---|
| Date of submission of the demand<br>12 November 2004 (12.11.2004)  | Date of completion of this report<br>23 November 2005 (23.11.2005)  |
| Name and mailing address of the IPEA/ US<br>Mail Stop PCT, Attn: IPEA/US<br>Commissioner for Patents<br>P.O. Box 1450<br>Alexandria, Virginia 22313-1450<br>Facsimile No. (571) 273-3201 | Authorized officer<br><br>J. Casimer Jacyna<br>Telephone No. 571-272-1000 |

Form PCT/IPEA/409 (cover sheet)(April 2005)

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/11302

## Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☐ the international application in the language in which it was filed.
- ☐ a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4(a))
- ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished
- ☒ the description:  
pages 1-7 as originally filed/furnished  
pages\* NONE received by this Authority on \_\_\_\_\_  
pages\* NONE received by this Authority on \_\_\_\_\_
- ☒ the claims:  
pages NONE as originally filed/furnished  
pages\* NONE as amended (together with any statement) under Article 19  
pages\* NONE received by this Authority on \_\_\_\_\_  
pages\* 8-13 received by this Authority on 05 July 2005 (05.07.2005)
- ☒ the drawings:  
pages NONE as originally filed/furnished  
pages\* NONE received by this Authority on \_\_\_\_\_  
pages\* 1/4-4/4 received by this Authority on 05 July 2005 (05.07.2005)
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☒ the claims, Nos. 41, 42
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/11302

## Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application

☒ claims Nos. 65-73

because:

☐ the said international application, or the said claim Nos. \_\_\_\_\_ relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. \_\_\_\_\_ are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. \_\_\_\_\_ are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

☒ no international search report has been established for said claims Nos. 65-73

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in a form and manner acceptable to it.

☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in a form and manner acceptable to it.

☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rules 13ter.1(a) or (b) and 13ter.2.

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, within the prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Preliminary Examining Authority in a form and manner acceptable to it.

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply with the technical requirements provided for in Annex C-bis of the Administrative Instructions.

☐ See Supplemental Box for further details

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/US04/11302

## Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

|                               |                                  |     |
|-------------------------------|----------------------------------|-----|
| Novelty (N)                   | Claims <u>1-16, 27-40, 42-59</u> | YES |
|                               | Claims <u>17-26, 60-64</u>       | NO  |
| Inventive Step (IS)           | Claims <u>1-16, 27-40, 42-59</u> | YES |
|                               | Claims <u>17-26, 60-64</u>       | NO  |
| Industrial Applicability (IA) | Claims <u>1-64</u>               | YES |
|                               | Claims <u>NONE</u>               | NO  |

### 2. Citations and Explanations (Rule 70.7)

Claims 17-26 and 60-64 lack novelty under PCT Article 33(2) as being anticipated by Itoi et al. 5,485,984. Itoi discloses a metal diaphragm valve 6 with a metal valve seat insert 7 having projections 15 and 16 which dig into the valve body 1 as disclosed on col. 3, lines 31-52. In regard to claim 41, Itoi also discloses a synthetic resin insert 12 which is chemically and thermally inert. In regard to claim 17, figure 1 of Itoi discloses fluid passage 8a to be immediately adjacent to an inner surface of the valve seat at 10 with both 8a and 10 having the same internal diameter and thereby being flush with each other. Note that the valve seat 7 is to be squished into 1 as disclosed on col. 3, lines 31-52 which will bring surfaces 7b and 8a closer together or flush as claimed. In regard to claim 60, the claim does not specify how the protrusion is dug in, only that it is in some manner dug in. Col. 3 clearly discloses that the protrusion is pushed and deformed against 1 which is a form of digging in as claimed.

Claims 1-16, 27-40 and 43-59 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a valve body crimped against a protrusion nor a valve seat that is harder than the metal diaphragm.

Claims 1-64 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

#### NEW CITATIONS

US 5,327,937 A (KATO et al.) 12 July 1994, see col. 4, lines 36-39.

US 5,485,984 A (ITOI et al.) 23 January 1996, see col. 2, lines 18-24, and col. 3, lines 31-52.

IPERUS

What is claimed is:

1. A diaphragm valve comprising:
  - a fluid passageway passing through a valve body;
  - a diaphragm for sealing said fluid passageway; and
  - a valve seat, wherein said valve seat includes one or more protrusions wherein a portion of the valve body is crimped against said one or more protrusions to secure the valve seat to the valve body.
2. The diaphragm valve of claim 1, wherein said valve seat is an insert formed separate from said valve body.
3. The diaphragm valve of claim 1, wherein said valve seat is inserted within a valve seat recess.
4. The diaphragm valve of claim 1, wherein said valve is inserted within a valve seat recess formed by an outer body wall and open to said fluid passageway.
5. The diaphragm valve of claim 4, wherein said open side of said valve seat is flush with said fluid passageway at a point where the valve seat and the valve body meet.
6. The diaphragm valve of claim 1, wherein said valve seat includes a raised sealing surface that generally matches the contour of a surface on said diaphragm.
7. The diaphragm valve of claim 1, wherein at least some portion of said valve seat is case hardened.
8. The diaphragm valve of claim 7, wherein said hardened portion of said valve seat is substantially free from carbides.
9. The diaphragm valve of claim 1, wherein the valve seat is greater than 55 Rockwell C.
10. The diaphragm valve of claim 1, wherein the valve seat is harder than the diaphragm.
11. The diaphragm valve of claim 1, wherein at least one of said one or more protrusions is on an outer edge of said metal valve seat.
12. The diaphragm valve of claim 1, wherein at least one said one or more protrusions is angled with respect to a center radius of the metal valve seat.

13. The diaphragm valve of claim 1, wherein at least one of said one or more protrusions is angled away from a seat bottom portion.
14. The diaphragm valve of claim 1, wherein said valve seat is metal.
15. The diaphragm valve of claim 1, wherein at least some portion of said valve seat is hardened.
16. The diaphragm valve of claim 1 further comprising a thin layer of polymeric material covering one or more surfaces of said valve seat.
17. A diaphragm valve comprising:
  - a fluid passageway disposed within a valve body;
  - a diaphragm for sealing said fluid passageway; and
  - a valve seat insert comprising an inner circumferential surface, wherein said inner circumferential surface is substantially flush with said fluid passageway at a point where the valve seat and valve body meet.
18. The diaphragm valve of claim 17, wherein said valve seat insert inner circumferential surface forms a continuous flow path with said fluid passageway.
19. The diaphragm valve of claim 17, wherein said valve seat insert inner circumferential surface is formed along the same axis as the fluid passageway.
20. The diaphragm valve of claim 17, wherein said valve seat insert further comprises a seat sealing surface, wherein said sealing surface is located proximate to said fluid passageway.
21. The diaphragm valve of claim 17, wherein said valve seat insert further comprises one or more protrusions for securing the valve seat to the valve body.
22. The diaphragm valve of claim 21, wherein said one or more protrusions form a seal surface between said valve seat and the valve body.
23. The diaphragm valve of claim 17, wherein at least some portion of the valve seat is hardened.
24. The diaphragm valve of claim 17, wherein at least some portion of the valve is case hardened.

26. The diaphragm valve of claim 17, wherein the valve seat is harder than the diaphragm.

27. A valve seat comprising:

a generally annular seat body; and  
one or more protrusions located on one or more surfaces of said seat body, wherein said one or more protrusions are used to secure and seal the valve seat to a valve body by crimping a portion of the valve body against said one or more protrusions.

28. The valve seat of claim 27, further comprising a sealing surface associated with said seat body.

29. The valve seat of claim 28, wherein said sealing surface is located along a top portion of the seat body, proximate to an inner surface of said valve seat.

30. The valve seat of claim 27, wherein at least some portion of the valve seat is hardened.

31. The valve seat of claim 27, wherein at least some portion of the valve seat is case hardened.

32. The valve seat of claim 27, wherein said valve seat is harder than a diaphragm with which it is used.

33. The valve seat of claim 27, wherein said valve seat is greater than 55 Rockwell C.

34. The valve seat of claim 27, wherein at least one of said one or more protrusions is angled with respect to the center radius of said valve seat.

35. A valve seat for a diaphragm valve, wherein at least some portion of the valve seat is hardened to greater than 55 Rockwell C.

36. The valve seat of claim 35, wherein said seat is case hardened.

37. The valve seat of claim 35 further comprising one or more protrusions located on one or more surfaces of said valve seat.

38. The valve seat of claim 35 further comprising a thin layer of polymeric material applied to one or more surfaces of said valve seat.

39. The valve seat of claim 35 wherein said valve seat is metal or ceramic.

40. The valve seat of claim 35, wherein said valve seat includes a sealing surface, said sealing surface being selectively case hardened.

41. (canceled)

42. (canceled)

43. A diaphragm valve comprising:

- a fluid passageway disposed within a valve body;
- a metal diaphragm for sealing said fluid passageway; and
- a valve seat, wherein said valve seat is harder than said metal diaphragm.

44. The diaphragm valve of claim 43, wherein said valve seat is an insert.

45. The diaphragm valve of claim 43, wherein said diaphragm is comprised of Elgiloy™.

46. The diaphragm valve of claim 43, wherein said valve seat is greater than 55 Rockwell C.

47. The diaphragm valve of claim 43, wherein said valve seat is metal.

48. The diaphragm valve of claim 43, wherein said valve seat is ceramic.

49. The diaphragm valve of claim 43, wherein at least some portion of the valve seat is hardened.

50. The diaphragm valve of claim 43, wherein at least some portion of the valve is case hardened.

51. The diaphragm valve of claim 43, wherein at least some portion of the valve is carburized.

52. The diaphragm valve of claim 43, wherein said valve seat further includes a thin layer of polymeric material on one or more surfaces of said valve seat.

53. The diaphragm valve of claim 43, wherein said valve seat further comprises one or more protrusions extending from one or more surfaces of said valve seat.

54. The diaphragm valve of claim 43, wherein said valve seat comprises one or more protrusions that are angled with respect to the center radius of said valve seat.



55. The diaphragm valve of claim 43, wherein said valve seat is harder than said valve body.

56. The diaphragm valve of claim 43, wherein a valve seat comprising an inner circumferential surface, wherein said inner circumferential surface is flush with said fluid passageway at a point where the valve seat and valve body meet.

57. The diaphragm valve of claim 56, wherein said valve seat inner circumferential surface forms a continuous flow path with said fluid passageway.

58. The diaphragm valve of claim 56, wherein said valve seat inner circumferential surface is formed along the same axis as the fluid passageway.

59. The diaphragm valve of claim 56, wherein said valve seat further comprises a seat sealing surface, wherein said sealing surface is located proximate to said fluid passageway.

60. A method of staking a valve seat insert comprising the steps of:  
inserting a valve seat insert into a recess formed in a valve body;  
providing one or more protrusions on one or more surfaces of said valve seat insert; and  
digging said one or more protrusions into at least one side wall of said valve body.

61. The method of claim 60, wherein said valve seat insert is metal.

62. The method of claim 60, further comprising the step of hardening at least some portion of said valve seat insert.

63. The method of claim 60 wherein said valve seat insert is harder than a diaphragm with which it is used.

64. A hardened metal valve seat insert, wherein said valve seat insert is removable.

65. A valve seat comprising:

- a) a generally annular seat body made from stainless steel or ceramic material;
- b) a thin layer of polymeric material applied to one or more surfaces of the seat body.

66. The valve seat of claim 65 wherein the seat body includes a sealing surface and the polymeric material is applied to the sealing surface.

67. A diaphragm valve comprising:

- a valve body that includes a fluid passageway;
- a diaphragm for sealing said fluid passageway; and
- a valve seat coated by a thin layer of polymeric material.

68. The diaphragm valve of claim 67 wherein a portion of the valve body is crimped against the valve seat to secure the valve seat to the valve body.

69. The diaphragm valve of claim 67 wherein the valve seat includes a protrusion that a portion of the valve body is crimped against to secure the valve seat to the valve body.

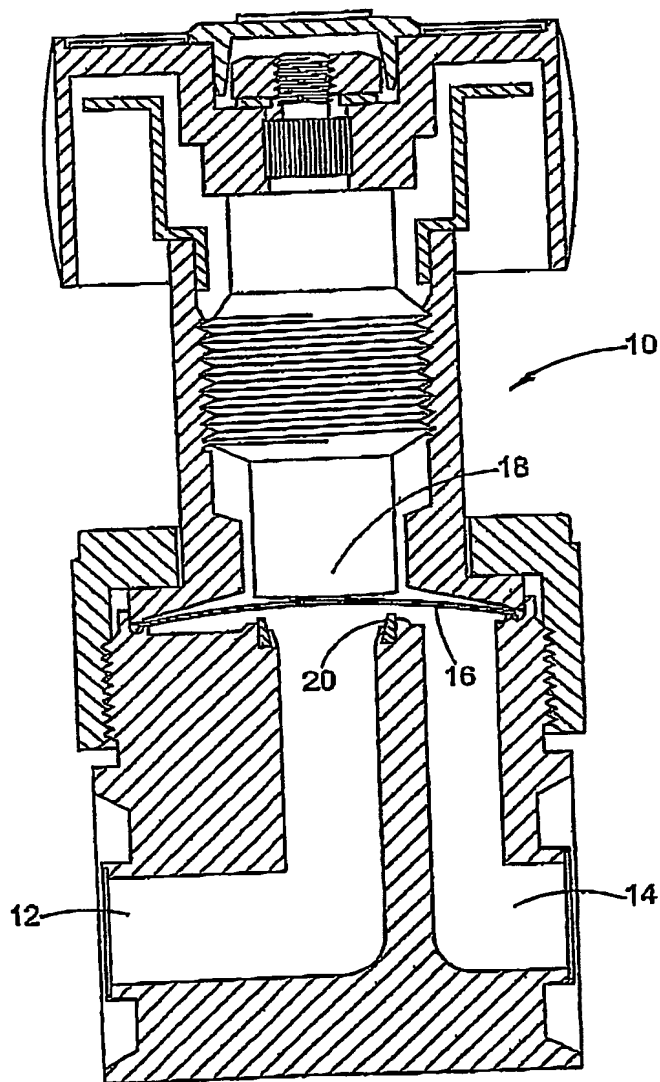
70. The diaphragm valve of claim 67 wherein an inner circumferential surface of the valve seat is substantially flush with said fluid passageway at a point where the valve seat and the body meet.

71. The diaphragm valve of claim 67 wherein the valve seat is made from a non-porous material.

72. The diaphragm valve of claim 67 wherein the valve seat is made from stainless steel.

73. The diaphragm valve of claim 67 wherein the thin layer of polymeric material is molded onto the valve seat.

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**FIG. 1**  
(PRIOR ART)

AMENDED SHEET

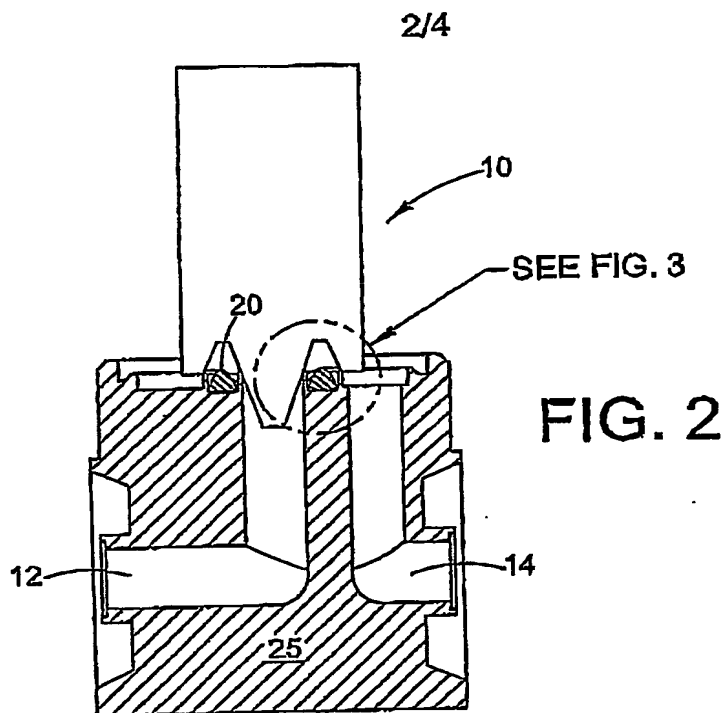


FIG. 3

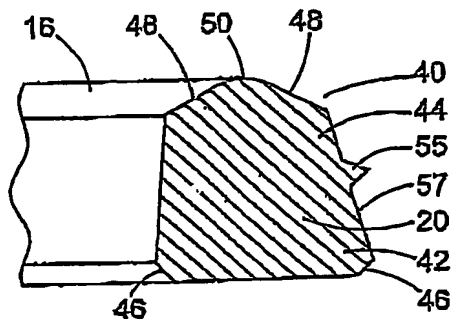
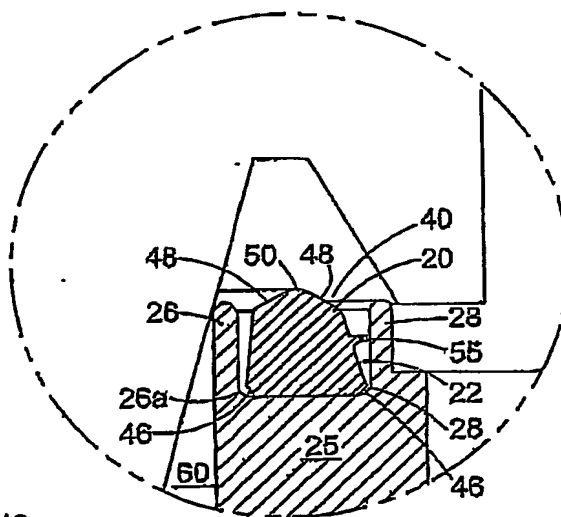


FIG. 4

AMENDED SHEET

3/4

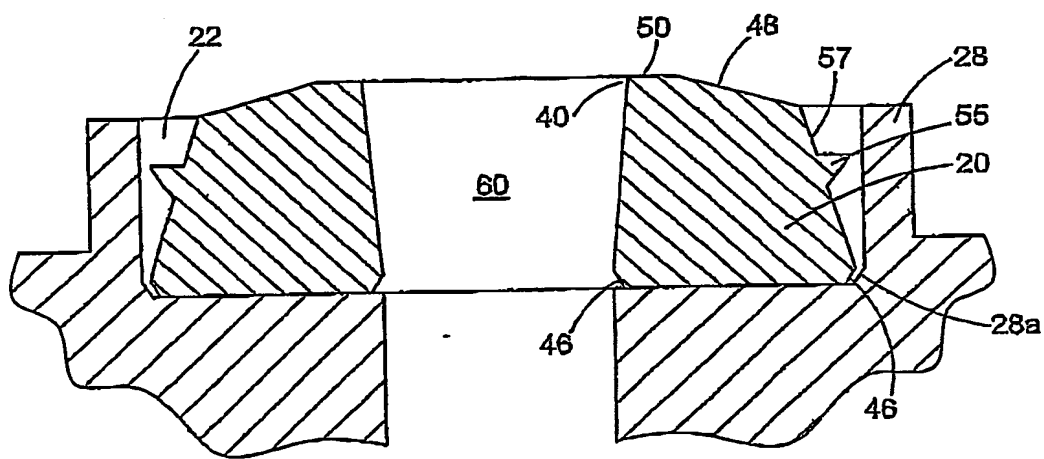


FIG. 5A

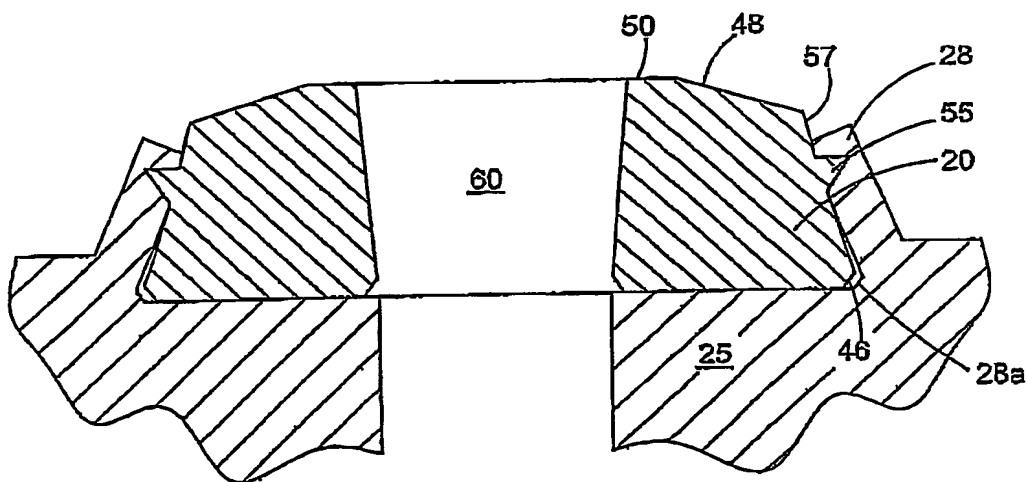
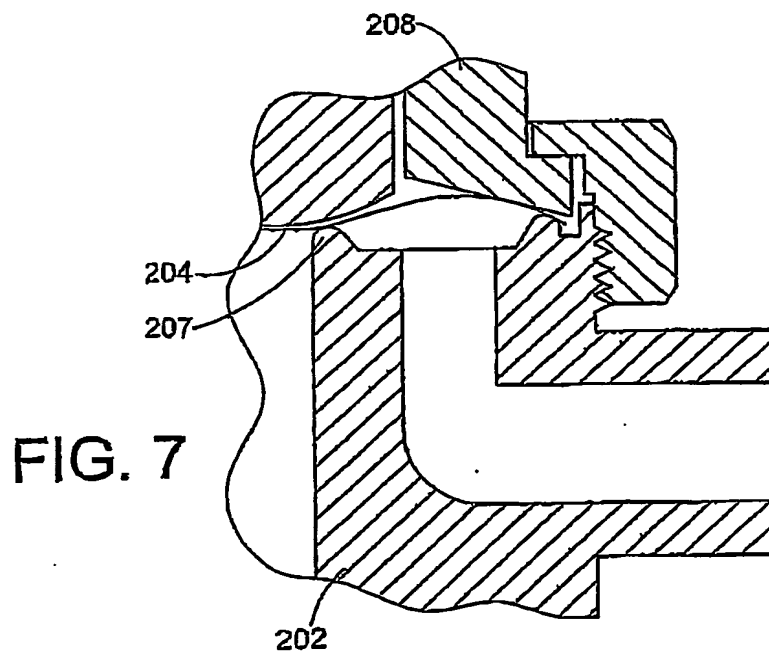
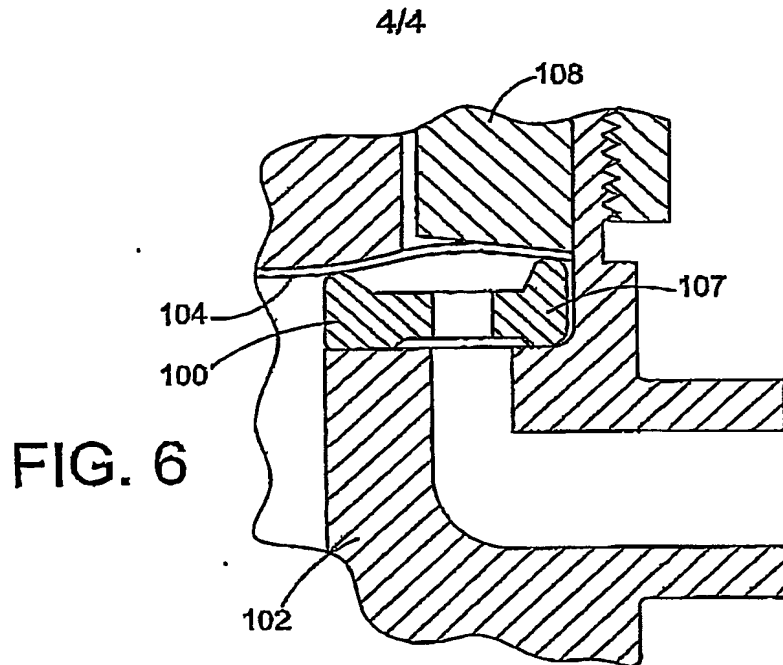


FIG. 5B

IPEA/US



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